Analyzing the Relationship Between Project Management and Social Responsibility at Peruvian University Los Andes: Graduate Perceptions for 2024 Using Plithogenic Statistics and the Indeterminate Likert Scale

Michael Raiser Vásquez-Ramírez[1,*], Ketty Marilú Moscoso-Paucarchuco[2], Kathy Lesslie Javier-Palacios[3], Neftali Llihua-Carrasco[1], Williams Ronald Olivera-Acuña[1], Maria Del Pilar Ureta-Vila[1], Manuel Michael Beraún-Espíritu[4]

[1]Universidad Peruana los Andes, Perú

[2]Universidad Nacional Autónoma Altoandina de Tarma, Perú

[3]Universidad Nacional Mayor de San Marcos, Perú

[4]Universidad Continental, Perú

Emails: d.mvasquezr@ms.upla.edu.pe; kmoscoso@unaat.edu.pe; kathy.javier@unmsm.edu.pe; d.nllihua@ms.upla.edu.pe; d.wolivera@ms.upla.edu.pe; d.muretav@ms.upla.edu.pe; mberaun@continental.edu.pe

Abstract

The university's mission as established in the World Declaration on Higher Education is to contribute to sustainable development and improve society, which implies training highly qualified professionals. This paper aims to determine to what extent Project Management is related to Social Responsibility at the Universidad Peruana Los Andes, 2024. For the study, a survey is applied to a sample of 384 graduates from a total population of 5823 distributed by faculties, in 2024 regarding the attitude of this university's Center on Project Management and University Social Responsibility. For data representation, we use an Indeterminate Likert Scale. This type of scale consists of the quantitative score of each of the possible nominal values, in this way the opinion of each respondent is captured more faithfully. On the other hand, we use the Plithogenic Statistics, because there are several variables to study, some of them with indeterminacies.

Keywords: Project Management; University Social Responsibility; Project Planning; Refined Neutrosophic Sets; Indeterminate Likert Scale; Plithogenic Statistics; Kendall's Tau b test

1. Introduction

The role of the university is to deliver high-level professionals to society. However, some Peruvian universities prioritize massification. There is little collaborative relationship between universities, which is preventing the attempt to surpass the low academic level of some of them. University Social Responsibility is working in this line in these times since globalization and too much dependence on economic development has created many social ills that universities could solve using knowledge, which forces them to understand the role of their stakeholders, identify their main stakeholders, and apply the corresponding strategies to deal with them. One of the possible ways of a positive change is the application of the concept of University Social Responsibility [1].

Regarding sustainability and social responsibility in Peruvian universities, some authors argue that with the enactment of Law 30220 in 2014, sustainability and University Social Responsibility were incorporated as part of university management. The study highlights the review of the "First Statistical Report on Sustainable Performance of Peruvian Universities", which includes 38 institutions, both public (16) and private (22), from which pertinent information was extracted on dimensions such as; government, environmental management, training, research and social projection, as well as the score achieved by each institution for the year 2020.

DOI: https://doi.org/10.54216/IJNS.260109

The main theoretical foundations based on the concepts of Project Management and University Social Responsibility emphasize that university projects, articulated to the vision of education and the mission of the university, underpin the capacity of them, and the alternatives of solutions to the problems and social needs of its area of influence. Thus, there is the perspective that project management is understood as the use of knowledge, skills, and techniques to execute projects effectively and efficiently. It is a strategic competence for organizations, which allows them to link the results of a project with commercial goals to better position themselves in the market.

Adding to the above ideas, the Project Management Association states that "project management focuses on controlling the introduction of desired change," which involves: understanding the needs of stakeholders, planning what needs to be done, when, by whom, and under what standards; creating and motivating the team, coordinating the work of different people, monitoring the work being done, managing any changes to the plan, and achieving satisfactory results. Thus, project management consists of "the application of knowledge, skills, tools, and techniques to the activities necessary to achieve project objectives" and involves the use of management processes for the initiation, planning, execution, control, and closing stages of the project.

The second theoretical foundation of the study is the definition of University Social Responsibility, which involves voluntary acts motivated by the advancement of social good. Maximizing profits and complying with the law is the essence of Corporate Social Responsibility.

Just like Corporate Social Responsibility companies, universities must go beyond the basic functions of teaching, research, and service. They must act voluntarily beyond legal requirements to promote the public good and environmental sustainability. In this regard, a sustainable university is understood as an institution that promotes the minimization of negative environmental, economic, social, and health effects generated by fulfilling its functions of teaching, research, extension and association, and administration, which help society migrate towards sustainable lifestyles [2].

On the other hand, University Social Responsibility reaches a broader horizon than educational policies to achieve university objectives in the environment in which they are developed, trying to promote the social utility of knowledge that contributes to improving the quality of life. Thus, University Social Responsibility is the responsibility shared by universities to contribute to social improvement through the integration of social responsibility with policies in institutional management, teaching, research, services, and public activities [3].

A more developed proposal on which the study is based is where university social responsibility is defined "as a policy of continuous improvement of the university towards the effective fulfillment of its social mission through four processes: a) Ethical and environmental management of the Institution, b) Training of responsible and supportive citizens, c) Production and dissemination of socially relevant knowledge and d) Social participation in promoting a more humane and sustainable development."[4]

The objective to be achieved with the research is to analyze to what extent Project Management is related to Social Responsibility at the Peruvian University Los Andes, during 2024.

To achieve greater accuracy, we use an Indeterminate Likert Scale [1, 2, 3, 4]. Unlike the classic Likert scale, in this generalization, each of the nominal elements of the scale is associated with a numerical value. This is used to capture different feelings, opinions, or thoughts of the respondent, which may be contradictory, however, the results are more reliable.

For statistical processing, Plithogenic Statistics is used [5-10]. This is the generalization of the Multivariate Classical Statistics and Neutrosophic Statistics. The Plithogenic Statistics is used when there is indeterminacy in a series of more than one variable that contains indeterminacy. The type of indeterminacy is more general than that included in Neutrosophic Statistics, the latter being the extension of classical statistics for interval-valued data or parameters, or when the population or sample size is indeterminate [11- 16]. However, Plithogenic Statistics contains these and other cases where data is combined in various ways.

This paper contains a Related Work section, where the basic notions of the Indeterminate Likert Scale and Plithogenic Statistics are explained. The following section is dedicated to showing the results of the study carried out, according to the method shown in [17]. The last section is dedicated to showing the conclusions.

2. Related Work

In this section, we present the basic elements of the Indeterminate Likert Scale and Plithogenic Statistics.

A. Indeterminate Likert Scale

Definition 1 ([7, 17]): The *Single-Valued Neutrosophic Set* (SVNS) N over U is $A = \{< x; T_A(x), I_A(x), F_A(x) > : x \in U\}$, where $T_A: U \to [0, 1]$, $I_A: U \to [0, 1]$, and $F_A: U \to [0, 1]$, $0 \leq T_A(x) + I_A(x) + F_A(x) \leq 3$.

DOI: https://doi.org/10.54216/IJNS.260109

Definition 2 ([7, 17]): The *refined neutrosophic logic* is defined such that: a truth T is divided into several types of truths: $T_1, T_2, \dots, T_p$, I into various indeterminacies: $I_1, I_2, \dots, I_r$ and F into various falsities: $F_1, F_2, \dots, F_s$, where all $p, r, s \geq 1$ are integers, and $p + r + s = n$.

Definition 3 ([7, 17]): A *triple refined indeterminate neutrosophic set* (TRINS) A in X is characterized by positive $P_A(x)$, indeterminacy $I_A(x)$, negative $N_A(x)$, positive indeterminacy $I_{P_A}(x)$ and negative indeterminacy $I_{N_A}(x)$ membership functions. Each of them has a weight $w_m \in [0, 1]$ associated with it. For each $x \in X$, there are $P_A(x), I_{P_A}(x), I_A(x), I_{N_A}(x), N_A(x) \in [0,1]$, $w_P^m(P_A(x)), w_{I_P}^m(I_{P_A}(x)), w_I^m(I_A(x)), w_{I_N}^m(I_{N_A}(x)), w_N^m(N_A(x)) \in [0, 1]$ and $0 \leq P_A(x) + I_{P_A}(x) + I_A(x) + I_{N_A}(x)(x) + N_A(x) \leq 5$. Therefore, a TRINS A can be represented by $A = \{\langle x; P_A(x), I_{P_A}(x), I_A(x), I_{N_A}(x), N_A(x)\rangle | x \in X\}$.

Let A and B be two TRINS in a finite universe of discourse, $X = \{x_1, x_2, \dots, x_n\}$, which are denoted by:

$A = \{\langle x; P_A(x), I_{P_A}(x), I_A(x), I_{N_A}(x), N_A(x)\rangle | x \in X\}$ and $B = \{\langle x; P_B(x), I_{P_B}(x), I_B(x), I_{N_B}(x), N_B(x)\rangle | x \in X\}$,

Where $P_A(x_i), I_{P_A}(x_i), I_A(x_i), I_{N_A}(x_i), N_A(x_i), P_B(x_i), I_{P_B}(x_i), I_B(x_i), I_{N_B}(x_i), N_B(x_i) \in [0, 1]$, for every $x_i \in X$.

Let w_i (i = 1,2,...,n) be the weight of an element x_i (i = 1,2,...,n), with $w_i \geq 0$ (i = 1,2,...,n) and $\sum_{i=1}^{n} w_i = 1$.

The generalized TRINS weighted distance is ([7, 17]):

$$d_\lambda(A, B) = \left\{\frac{1}{5}\sum_{i=1}^{n} w_i \left[|P_A(x_i) - P_B(x_i)|^\lambda + \left|I_{P_A}(x_i) - I_{P_B}(x_i)\right|^\lambda + |I_A(x_i) - I_B(x_i)|^\lambda + \left|I_{N_A}(x_i) - I_{N_B}(x_i)\right|^\lambda + |N_A(x_i) - N_B(x_i)|^\lambda\right]\right\}^{1/\lambda} \quad (1)$$

Where $\lambda > 0$.

The Indeterminate Likert Scale is formed by the following five elements:

– Negative membership,
– Indeterminacy leaning towards negative membership,
– Indeterminate membership,
– Indeterminacy leaning towards positive membership,
– Positive membership.

These values substitute the classical Likert scale with values:

–Strongly disagree,
– Disagree,
–Neither agree or disagree,
– Agree,
– Strongly agree.

B. Plithogenic Statistics

Plithogenic Statistics has as its aim to study the analysis and observation of events as in classical statistics. It is a generalization of the classical Multivariate Statistics, where multivariate results of neutrosophic or indeterminate variables are analyzed.

For example, according to the example in Smarandache about Plithogenic Neutrosophic Probability (PNP), $PNP(Jenifer) = \{(0.5, 0.9, 0.2), (0.6, 0.7, 0.4), (0.8, 0.2, 0.1), (0.4, 0.3, 0.5)\}$ which consists of the neutrosophic probabilities that Jenifer will pass each of the 4 subjects corresponding to the semester. For example, to pass Differential Equations she has 50% of success rate, 20% of failure rate, and 90% of indeterminacy rate. That is why the neutrosophic probability of passing the semester is $(\min\{0.5, 0.6, 0.8, 0.4\}, \max\{0.9, 0.7, 0.2, 0.3\}, \max\{0.2, 0.4, 0.1, 0.5\}) = (0.4, 0.9, 0.5)$.

Regarding Plithogenic Refined Probability (PRP), probabilities are generalized to the case where there is more than one value of truthfulness of probabilities, more than one value of indeterminacy, or more than one value of falsity. The illustrative example used by Smarandache is the following:

Suppose that for each subject Jenifer has to be evaluated in two tests, one oral and the other written. Then the set of probabilities is refined as : $T_1(\text{oral test})$, $T_2(\text{written test})$; $I_1(\text{oral test})$, $I_2(\text{written test})$; and $F_1(\text{oral test})$, $F_2(\text{written test})$.

So,

$$PRP(Jenifer) = \{((0.5, 0.6), (0.4, 0.7), (0.1, 0.2)), ((0.6, 0.8), (0.0, 0.7), (0.3, 0.4)), ((0.8, 0.8), (0.1, 0.2), (0.1, 0.0)), ((0.3, 0.7), (0.2, 0.3), (0.5, 0.4))\}$$

For example, $((0.5, 0.6), (0.4, 0.7), (0.1, 0.2))$ means that concerning the first subject, Jenifer has a 50% probability of passing the oral test and a 60% probability of passing the written test; 40% indeterminacy whether she will pass the oral test and 70% of indeterminacy whether she will pass the written test; while there is 10% of chance of not passing the oral exam and 20% of chance of not passing the written exam.

DOI: https://doi.org/10.54216/IJNS.260109

3. The Results

In our research, we were inspired by the methodology that appears in [17, 18]. This consists of the following:

1. A group of graduates from the Universidad Peruana Los Andes are surveyed. Each question is answered based on the Indeterminate Likert Scale shown in Figure 1.

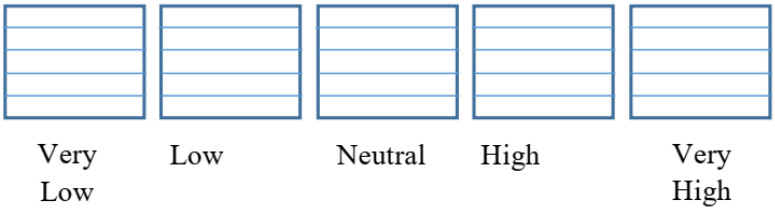

Figure 1. Indeterminate Likert Scale used in the survey. Source: [17].

Figure 2 shows an example of the use of this scale.

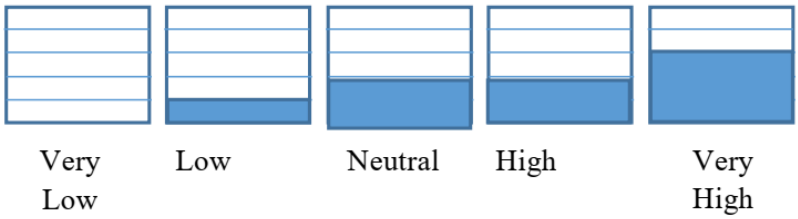

Figure 2. Example of the use of the Indeterminate Likert Scale proposed in the survey. Source: [17].

As shown in Figure 2, the quintuple $(3,2,2,1,0)$ that is divided by 5 to obtain values in $[0,1]^5$ is exemplified. In this way, the example is rescaled to $\left(\frac{3}{5},\frac{2}{5},\frac{2}{5},\frac{1}{5},0\right)$.

This means that the respondent answers as "Very High" in 3/5, "High" in 2/5, "Neutral" in 2/5, "Low" in 1/5 and "Very Low" at 0.

2. The quintuples of the survey values are then converted into a single real numerical value, using the following equation:

$$\gamma(V) = 2v_1 + v_2 + 0.5v_3 - v_4 - 2v_5 \qquad (1)$$

Where $V = (v_1, v_2, v_3, v_4, v_5) \in [0,1]^5$ is a vector that represents the evaluation such that v_1 represents the evaluation of "Very High", v_2 that of "High", v_3 that of "Neutral", v_4 that of "Low", and v_5 that of "Very Low".

3. Respondents are asked about the measures corresponding to each of the two variables being measured, which are:

Project Management (M),

The measures taken into account to measure Project Management are:

M_1: Dedicate a minimum amount of time to execute the projects,

M_2: Allocate a minimum cost to execute the projects,

M_3: Perform adequately to execute projects,

M_4: Minimize risks to execute projects,

M_5: Satisfy customers when projects are completed.

University Social Responsibility (S),

The University's Social Responsibility measures are:

DOI: https://doi.org/10.54216/IJNS.260109

S_1: Responsible Campus,

S_2: Professional and civic training,

S_3: Social Knowledge Management,

S_4: Social Management Impacts.

Each graduate surveyed in the sample offers an opinion for each of the measures $M = \{M_1, M_2, M_3, M_4, M_5\}$ and $S = \{S_1, S_2, S_3, S_4\}$.

For example, the graduate x is assigned the following survey values regarding Plithogenic Refined Probability (PRP):

$$PRP(x) = \left\{ \begin{matrix} (v_{1M_1x}, v_{2M_1x}, v_{3M_1x}, v_{4M_1x}, v_{5M_1x}), (v_{1M_2x}, v_{2M_2x}, v_{3M_2x}, v_{4M_2x}, v_{5M_2x}), (v_{1M_3x}, v_{2M_3x}, v_{3M_3x}, v_{4M_3x}, v_{5M_3x}), \\ (v_{1M_4x}, v_{2M_4x}, v_{3M_4x}, v_{4M_4x}, v_{5M_4x}), (v_{1M_5x}, v_{2M_5x}, v_{3M_5x}, v_{4M_5x}, v_{5M_5x}), (v_{1S_1x}, v_{2S_1x}, v_{3S_1x}, v_{4S_1x}, v_{5S_1x}), \\ (v_{1S_2x}, v_{2S_2x}, v_{3S_2x}, v_{4S_2x}, v_{5S_2x}), (v_{1S_3x}, v_{2S_3x}, v_{3S_3x}, v_{4S_3x}, v_{5S_3x}), (v_{1S_4x}, v_{2S_4x}, v_{3S_4x}, v_{4S_4x}, v_{5S_4x}) \end{matrix} \right\}$$

This means that the graduate of the name x thinks that the time spent at Universidad Peruana Los Andes to execute the projects is $V_{M_1x} = (v_{1M_1x}, v_{2M_1x}, v_{3M_1x}, v_{4M_1x}, v_{5M_1x})$; $V_{M_2x} = (v_{1M_2x}, v_{2M_2x}, v_{3M_2x}, v_{4M_2x}, v_{5M_2x})$ is the evaluation of the cost spent on the projects, and so on. Note that the evaluations are qualitative on the variables, for example, an evaluation of “Very High" means that the cost is assigned excellently, not that the cost spent is very high.

The sample of graduates is probabilistic, stratified by professional careers, and includes a sample of 384 graduates 2024 made up of 5 strata consisting of graduates by faculties. The sample size was calculated using Equation 2:

$$n = \frac{k^2 Npq}{e^2(N-1)+k^2 pq} \qquad (2)$$

n = Sample size (?),

N = Population size (5823),

Z = It is the deviation for the desired confidence level (1.96),

e = Maximum allowed error margin (0.05),

p = It is the proportion that we expect to find (p= 0.5),

By calculating we obtain:

n = 384 graduates.

Then, Equation 1 is applied to each of the quintuplets to obtain nine values in $[0, 1]$ (5 for project management and 4 for Social Responsibility). The Kendall Tau b statistical test is applied to these values that are in the interval.

The τ Kendall test is also used in [17], it consists of the following:

1. There are n pairs of measurements of two variables (X, Y).
2. Order the observations in the variable X from 1 to n. Order the observations Y from 1 to n.
3. Arrange the list of n subjects so that the subjects' ranks in the variable X are in their natural order; this is 1, 2, 3,…, n.
4. Reorder the ranges Y in the order in which they occurred when the ranges X are in the natural order. Determine the values of S, the number of agreements in the order minus the number of disagreements in the order, for the observed orders in the ranges of Y.

If there are no ties between the observations X or Y, use Equation 3 to calculate the value of T.

$$T = \frac{2S}{n(n-1)} \qquad (3)$$

If there are ties, use Equation 4.

DOI: https://doi.org/10.54216/IJNS.260109

$$T = \frac{2S}{\sqrt{n(n-1)-T_x}\sqrt{n(n-1)-T_y}} \qquad (4)$$

Where $T_x = \sum t(t-1)$ is the number of tied observations in each group of ties in the variable X.

$T_y = \sum t(t-1)$ is the number of tied observations in each group of ties in the variable Y.

5. If the n subjects constitute a random sample from some population, the hypothesis that the variables are independent in that population can be tested, so calculate the value z associated with T using Equation 5.

6. $$z = \frac{T-\mu_T}{\sigma_T} = \frac{3T\sqrt{n(n-1)}}{\sqrt{2(2n+5)}} \qquad (5)$$

In particular, Kendall's Tau b test makes certain adjustments in case of a tie.

Below we show the results obtained, but first, we must make adjustments to the data as follows:

If $X = \{x_1, x_2, \dots, x_{384}\}$ is the set of surveyed individuals, $V_{M_j x_i} = \left(v_{1M_j x_i}, v_{2M_j x_i}, v_{3M_j x_i}, v_{4M_j x_i}, v_{5M_j x_i}\right)$ where $i = 1, 2, \dots, 384$ and $j = 1, 2, \dots, 5$ are the results of the ith respondent on the jth sub-variable of the "Project Management" variable, while $V_{S_k x_i} = \left(v_{1S_k x_i}, v_{2S_k x_i}, v_{3S_k x_i}, v_{4S_k x_i}\right)$ where $k = 1, 2, \dots, 4$ are the results of the ith respondent on the kth sub-variable of the "University Social Responsibility" variable. To obtain a total aggregate value of both variables from the sub-variables for each respondent, Equations 6 and 7 are applied:

$$V_{Mx_i} = \left(min_j\left\{v_{1M_j x_i}\right\}, min_j\left\{v_{2M_j x_i}\right\}, max_j\left\{v_{3M_j x_i}\right\}, max_j\left\{v_{4M_j x_i}\right\}, max_j\left\{v_{5M_j x_i}\right\}\right) \qquad (6)$$

$$V_{Sx_i} = \left(min_k\{v_{1S_k x_i}\}, min_k\{v_{2S_k x_i}\}, max_k\{v_{3S_k x_i}\}, max_k\{v_{4S_k x_i}\}, max_k\{v_{5S_k x_i}\}\right) \qquad (7)$$

Equation 1 is applied to each of them to obtain unique numerical values for each respondent for each of the variables. Then the Kendall Tau b Test algorithm is applied to the pairs obtained.

The result is shown in Table 1.

Table 1: Calculation of the Tau b test about the correlation between variables M and S.

				M	S
Tau_b Kendall	by	Project management	Correlation coefficient	1.00	.664**
			Next (one-sided)	.	.000
			N	384	384
		University Responsibility	Social Correlation coefficient	.664**	1.00
			Next (one-sided)	.000	.
			N	384	384

**. The correlation is significant at the 0.01 level (one-tailed).

The results in the table show that the p-value is 0.000 < α=0.05, allowing us to reject the null hypothesis and affirm that there is a high correlation between Project Management and University Social Responsibility.

When the algorithm is applied to variable S concerning a sub-variable of M, e.g., S and M_1, S and M_2, we obtain the results shown below. See Tables 2-6:

DOI: https://doi.org/10.54216/IJNS.260109

Table 2: Calculation of the Tau b test about the correlation between the variables M_1 and S.

			M_1	S
Tau_b Kendall	byM_1	Correlation coefficient	1.00	.596**
		Next (one-sided)	.	.000
		N	384	384
	S	Correlation coefficient	.596**	1.00
		Next (one-sided)	.000	.
		N	384	384

**. The correlation is significant at the 0.01 level (one-tailed).

Table 3: Calculation of the Tau b test about the correlation between the variables M_2 and S.

			M_2	S
Tau_b Kendall	byM_2	Correlation coefficient	1.00	.649**
		Next (one-sided)	.	.000
		N	384	384
	S	Correlation coefficient	.649**	1.00
		Next (one-sided)	.000	.
		N	384	384

**. The correlation is significant at the 0.01 level (one-tailed).

Table 4: Calculation of the Tau b test about the correlation between the variables M_3 and S.

			M_3	S
Tau_b Kendall	byM_3	Correlation coefficient	1.00	.550**
		Next (one-sided)	.	.000
		N	384	384
	S	Correlation coefficient	.550**	1.00
		Next (one-sided)	.000	.
		N	384	384

**. The correlation is significant at the 0.01 level (one-tailed).

DOI: https://doi.org/10.54216/IJNS.260109

Table 5: Calculation of the Tau b test about the correlation between the variables M_4 and S.

			M_4	S
Tau_b Kendall	byM_4	Correlation coefficient	1.00	.612**
		Next (one-sided)	.	.000
		N	384	384
	S	Correlation coefficient	.612**	1.00
		Next (one-sided)	.000	.
		N	384	384

**. The correlation is significant at the 0.01 level (one-tailed).

Table 6: Calculation of the Tau b test about the correlation between the variables M_5 and S.

			M_5	S
Tau_b Kendall	byM_5	Correlation coefficient	1.00	.700**
		Next (one-sided)	.	.000
		N	384	384
	S	Correlation coefficient	.700**	1.00
		Next (one-sided)	.000	.
		N	384	384

**. The correlation is significant at the 0.01 level (one-tailed).

4. Conclusion

In this article, we carry out a study of the relationship between Project Management and University Social Responsibility according to the opinion of a group of graduates of the Universidad Peruana Los Andes during the year 2024. The study was based on a survey carried out on a sample of 384 graduates of this university. An Indeterminate Likert Scale was used to measure the opinion of the respondents and the results were processed with the help of the Plithogenic Statistics. The final results were obtained after applying a Kendall Tau b test.

The Indeterminate Likert Scale allows to capture more reliably the opinions of the respondents, even when these opinions may be contradictory, although more realistic. The Plithogenic Statistics allows the processing of problems with more than one measured variable. Thus, we have concluded that there is a significant correlation between "University Social Responsibility" and "Project Management". There is also a significant correlation between "University Social Responsibility" and the sub-variables of "Project Management", such as: "time", "cost", "performance", "risk" and "customer satisfaction". Therefore, it is recommended to improve these five indicators of project management to achieve greater responsibility for this university in the community.

Funding: This research received no external funding

Conflicts of Interest: The authors declare no conflict of interest.

DOI: https://doi.org/10.54216/IJNS.260109

References

[1] H. Acıoğlu, "Sezgisel Bulanik Kümeler ve Neutrosophic Kümeler Üzerine Bazi Çok Kriterli Karar Verme Metotlari," in New Trends in Neutrosophic Theory and Applications, vol. II, BiblioPublishing, Ohio, USA, 2023.

[2] R. Arias Figueroa, E. Tovar Molina, A. Romero Poveda, and D. Díaz Muñoz, "Comparison of Fuzzy Cognitive Maps and SEM in Estimating the Perception of Corporate Social Responsibility," Neutrosophic Sets and Systems, vol. 69, no. 1, p. 15, 2024.

[3] H. Deniz, Bazi Neutrosophic Kümeler Üzerindeki Karar Verme Metodlari ve Uygulamalari, BiblioPublishing, Ohio, USA, 2023.

[4] K. Ö. Karagülle, "TOPSIS Method and Applications on Bipolar Single Valued Neutrosophic Graphs," GLOBAL KNOWLEDGE Publishing House, USA, 2022.

[5] F. Smarandache, "Plithogenic Probability & Statistics are Generalizations of MultiVariate Probability & Statistics," Neutrosophic Sets & Systems, vol. 43, 2021.

[6] S. İ. Karagülle, "Neutrosophic Valued Neutrosophic Crisp Sets," GLOBAL KNOWLEDGE Publishing House, USA, 2022.

[7] E. F. Q. Alarcón, H. C. Huachaca, L. M. S. Justiniano, Y. M. A. Arias, M. L. M. Hidalgo, and D. M. M. Fernández, "Sentiment Analysis and NeutroAlgebra to Evaluate Organizational Strategies and Performance Levels of Basic Education Teachers," Neutrosophic Sets and Systems, vol. 74, pp. 285–296, 2024.

[8] D. H. De la Cantera, R. C. Quiroz, M. L. Queija, J. R. Gonzalez, and M. Y. L. Vazquez, "Analyzing Interdisciplinary Education in General Medicine Using Smarandache's Multivalued Logic Hypothesis Theory and Plithogenic Probability," Neutrosophic Sets and Systems, vol. 70, pp. 369–377, 2024.

[9] T. V. Vahini and M. T. Pricilla, "A Neutrosophic Micro Vague Correlation Measure: Application to Multi-Criteria Decision Making Problems," Neutrosophic Systems With Applications, vol. 25, pp. 30–37, 2025. DOI: 10.61356/j.nswa.2025.25432

[10] D. D. Valencia-Yaguana, S. F. Moreno-Faconda, and M. A. Rivera-Moreno, "Optimizing Pest Management in Sugarcane Cultivation: An Integrative Approach using Neutrosophic Statistics and Plithogenic Analysis," Neutrosophic Sets and Systems, vol. 69, pp. 143–151, 2024.

[11] M. Şahin and A. Kargın, "Bipolar Generalized Set Valued Neutrosophic Quadruple Sets and Numbers," in Neutrosophic Algebraic Structures and Their Applications, NSIA Publishing House, Los Rios, Ecuador, 2022.

[12] M. Abobala, "A Review on Recent Advances in Algebraic Theory of Neutrosophic Matrices," Journal of Algebraic Structures and Their Applications, vol. 5, no. 2, pp. 45–59, 2021.

[13] M. Aslam, "Analyzing Wind Power Data Using Analysis of Means Under Neutrosophic Statistics," Soft Computing, vol. 25, no. 10, pp. 7087–7093, 2021.

[14] U. Afzal and M. Aslam, "A Study of Human Respiration Rate Through Neutrosophic Statistics," in Cognitive Intelligence with Neutrosophic Statistics in Bioinformatics, Academic Press, pp. 173–187, 2023.

[15] N. Olgun, "NeutroSets, NeutroRelations and Its Applications," in Neutrosophic SuperHyperAlgebra and New Types of Topologies, GLOBAL KNOWLEDGE Publishing House, Miami, Florida, USA, 2023.

[16] A. AlAita and M. Aslam, "Analysis of Covariance Under Neutrosophic Statistics," Journal of Statistical Computation and Simulation, vol. 93, no. 3, pp. 397–415, 2023.

[17] B. F. Camayo-Lapa, F. L. K. Ninozca, L. E. Landa-Guadalupe, M. A. Quispe-Solano, E. A. De La Cruz Porta, L. B. J. Luis, C. F. Cabrera-Carranza, and A. S. C. Mandamiento, "Characterization of Social Skills and Emotion Management of Students in a Public Peruvian University Based on Plithogenic Statistics and Indeterminate Likert Scale," Neutrosophic Sets and Systems, vol. 62, pp. 28–35, 2023.

[18] I. Silambarasan, "Some Algebraic Structure of Spherical Neutrosophic Matrices," TWMS Journal of Applied and Engineering Mathematics, vol. 13, no. 3, pp. 1177–1189, 2023.

[19] B. F. Camayo-Lapa et al., "Characterization of Social Skills and Emotion Management of Students in a Public Peruvian University Based on Plithogenic Statistics and Indeterminate Likert Scale," Neutrosophic Sets and Systems, vol. 62, pp. 28–35, 2023.

DOI: https://doi.org/10.54216/IJNS.260109